

BIS(CHLOROMETHYL)ETHER

Bis(chloromethyl)ether is a federal hazardous air pollutant and was identified as a toxic air contaminant in April 1993 under AB 2728.

CAS Registry Number: 542-88-1

$\text{ClCH}_2\text{OCH}_2\text{Cl}$

Molecular Formula: $\text{C}_2\text{H}_4\text{Cl}_2\text{O}$

Bis(chloromethyl)ether is a colorless, volatile liquid with a suffocating odor. It is miscible with alcohol, ether, and many organic solvents (HSDB, 1991). It may form spontaneously in warm moist air from the combination of formaldehyde and hydrogen chloride (Sittig, 1985). Bis(chloromethyl)ether emits toxic fumes of chloride when heated to decomposition (Sax, 1989).

Physical Properties of Bis(chloromethyl)ether

Synonyms: sym-dichloromethyl ether; oxybis(chlormethane); dichloromethyl ether; chloro(chlormethoxy)methane; dimethyl-1,1'-dichloroether; BCME

Molecular Weight:	114.97
Boiling Point:	106 °C
Melting Point:	-41.5 °C
Flash Point:	<19 °C
Vapor Density:	4.0 (air = 1)
Density/Specific Gravity:	1.315 at 20/4 °C
Vapor Pressure:	30 mm Hg at 22 °C
Log Octanol/Water Partition Coefficient:	Hydrolyzes rapidly in water
Conversion Factor:	1 ppm = 4.7 mg/m ³

(Howard, 1990; HSDB, 1991; Sax, 1989; U.S. EPA, 1994a)

SOURCES AND EMISSIONS

A. Sources

Bis(chloromethyl)ether is used as a chemical intermediate for ion-exchange resins and as a laboratory reagent (Sax, 1987). It is reported to form spontaneously from formaldehyde and chloride ions in moist air. The primary stationary sources that have reported emissions of bis(chloromethyl)ether in California are legal services (ARB, 1997b).

B. Emissions

The total emissions of bis(chloromethyl)ether from stationary sources in California are estimated to be less than 1 pound per year, based on data reported under the Air Toxics “Hot Spots” Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

Bis(chloromethyl)ether does not occur in nature (HSDB, 1991).

AMBIENT CONCENTRATIONS

No Air Resources Board data exist for ambient concentrations of bis(chloromethyl)ether.

INDOOR SOURCES AND CONCENTRATIONS

No information about the indoor sources and concentrations of bis(chloromethyl)ether was found in the readily-available literature.

ATMOSPHERIC PERSISTENCE

It is estimated that bis(chloromethyl)ether will degrade from reaction with photochemically produced hydroxyl (OH) radicals. Based on the OH radical rate constant for bis(chloromethyl)ether (Kwok and Atkinson, 1995), the calculated half-life and lifetime of bis(chloromethyl)ether due to reaction with the OH radical is estimated to be 1.7 and 2.4 days, respectively (Atkinson, 1995). The hydrolysis half-life of bis(chloromethyl)ether in humid air is less than 18 hours (HSDB, 1991).

AB 2588 RISK ASSESSMENT INFORMATION

Since no emissions of bis(chloromethyl)ether from stationary sources in California have been reported under the AB 2588 program, it was not listed in any of the risk assessments reviewed by the Office of Environmental Health Hazard Assessment.

HEALTH EFFECTS

The most probable route of human exposure to bis(chloromethyl)ether is inhalation (HSDB, 1991).

Non-Cancer: Exposure to bis(chloromethyl)ether vapor causes eye, nose, throat, skin, and respiratory tract irritation (HSDB, 1991; Sittig, 1991). Long-term exposure causes chronic bronchitis, chronic cough, and impaired respiratory function (U.S. EPA, 1994a).

The United States Environmental Protection Agency (U.S. EPA) has not established a Reference Concentration (RfC) nor an oral Reference Dose (RfD) for bis(chloromethyl)ether

(U.S. EPA, 1994a).

Very little information is available on adverse reproductive and developmental effects of bis(chloromethyl)ether. Rats exposed to bis(chloromethyl)ether by inhalation showed no effect on the testes (U.S. EPA, 1994a).

Cancer: An increased incidence of human lung carcinomas (primarily small cell undifferentiated) were found in studies of workers exposed to bis(chloromethyl)ether. The latency period was relatively short - 10 to 15 years (Sittig, 1991).

The U.S. EPA has placed bis(chloromethyl)ether in Group A: Known human carcinogen with an inhalation unit risk estimate of 6.2×10^{-2} (microgram per cubic meter)⁻¹. The U.S. EPA estimates that, if an individual were to breathe air containing bis(chloromethyl)ether at 1.6×10^{-5} micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) over an entire lifetime, that person would theoretically have no more than a 1 in 1 million increased chance of developing cancer (U.S. EPA, 1994a). The International Agency for Research on Cancer has placed bis(chloromethyl)ether in Group 1: Human carcinogen (IARC, 1987a).

The State of California has determined under Proposition 65 that bis(chloromethyl)ether is a carcinogen (CCR, 1996). The inhalation potency factor that has been used as a basis for regulatory action in California is 1.3×10^{-2} (microgram per cubic meter)⁻¹ (OEHHA, 1994). In other words, the potential excess cancer risk for a person exposed over a lifetime to $1 \mu\text{g}/\text{m}^3$ of bis(chloromethyl)ether is estimated to be no greater than 13,000 in 1 million. The oral potency factor that has been used as a basis for regulatory action in California is 460 (milligram per kilogram per day)⁻¹ (OEHHA, 1994).

